On the Solar Eclipse of the 22nd of December, 1870.

By Charles H. Weston, F.R.A.S., &c.

The day of the eclipse proved at my Observatory very unfavourable for critically examining its phenomena. The upper sky was marked by *cirri-strati*, resulting from a southerly current in high regions, while near the earth a strong north-easterly wind brought heavy *nimbi*, with the low temperature of 23° Fahr. in the shade. The consequence of the aerial strata thus differing abruptly both in specific gravity and moisture would necessarily be a bad definition for telescopic observations, and thus the appulse and advance of the Moon on the Sun's disc were disfigured with boiling undulations.

I had previously marked the groups of solar maculæ for further testing refrangibility at the lunar surface, and especially the behaviour of the large spots, both as to their vertical and horizontal contour during the passage of the line of darkness over them. But the great undulations rendered futile all such attempts and all endeavours to trace irregularity in the Moon's edge, or to watch the solar cusps. Amidst this general failure, however, I noticed one interesting apparition, viz., that the disk of the Moon overlapping the Sun was *not uniformly dark, but enlightened for some distance from its periphery coextensively with the arc of contact.*

As I wished to test the correctness of my vision, I begged my friend Captain De Blaquiere (who had kindly undertaken to register all meteorological details throughout the eclipse) to come to the telescope and give me his impressions, when I found my own opinion confirmed.*

I shall pass over the several accounts given in our *Monthly Notices* of former eclipses connected with a bright border adjacent, but *exterior* to the Moon's limb, and the mathematical discussions to which they led, because such would be foreign to my present subject, which concerns an enlightenment *within* the Moon's disk. I shall, therefore, refer first to the account of the annular eclipse of 1858 given by Mr. Stuart.† The observations on this occasion were made under somewhat similar circumstances to my own, and the writer states that "the light from the Sun was very distinctly seen *within* the edge, and slightly illuminating the dark body of the Moon for a short distance," and that his impression at the time was that "the solar light was inflected by a rare lunar atmosphere however doubtful." The same eclipse was also watched by Sir John Herschel,‡ and by Messrs. Dawes and Breen,§ and although with a clouded and broken sky, *yet under very favourable defining conditions;* and then the lunar disk did

* Telescope used on that day was the Newtonian Reflector, 9 inches diameter and 9 feet focal length.

† *Monthly Notices*, vol. xviii. pp. 193–4. ‡ Ibid. p. 211.

§ Ibid. pp. 188–206.

not contain any partial illumination, expressly so in the account of Sir John Herschel and Mr. Breen, and impliedly so in that of Mr. Dawes.

I have also referred to a description of the Solar Eclipse of 1836 by Admiral Smyth,* from which it would also appear that no partial illumination was then seen on the Moon, and although it is remarked that at first the lunar limb was somewhat tremulous, it yet soon became steady and *the definition pre-eminently fine*.

The suggestion cautiously thrown out by Mr. Stuart as to whether this lunar illumination resulted from the frangibility of a lunar atmosphere was *per se* a very natural one, but when considered in connexion with contemporary observations it cannot be deemed valid. The united testimony on that occasion of Sir John Herschel and Messrs. Dawes and Breen under such favourable circumstances has set at rest the question of any visible refrangibility, and, therefore, the rationale of the illumination of the lunar surface must be sought for in some other cause.

The next step was to learn what other Astronomers had noticed during the last solar eclipse. Sir John Herschel very obligingly replied to my questions, and I have his permission to state that he did not see any particular light on the Moon and that it seemed to be uniformly and absolutely black, and that certainly the Moon looked darker than the solar spots, *i.e.* their *average* illumination for the low magnifier used did not allow a sight of the nuclei.

The case, therefore, seems to stand thus:—When the definition is really good no such particular illumination of the Moon's disk seems to have been remarked; but when the definition is bad, and the Moon's edge boiling, then a greater or less amount of such illumination seems to have been observable.

Would not the inference consequently be that this apparition must rather be the result of the conditions of the atmospheric medium through which the celestial bodies were viewed than connected with the bodies themselves? Or does it not arise from "one of those strictly ocular nervous phenomena not properly subjective, but sensational," alluded to by the Astronomer Royal in his very valuable paper on the lunar luminous band?†

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Note on Oudemann's Theory of the Coronal Radiations.

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The papers read at the last meeting on the subject of the recent eclipse were so full of interest that it seemed desirable not

* *Celestial Cycle*, vol. i. pp. 140–2.
† *Monthly Notices*, vol. xxiv. p. 18.